The Plant Doctor's LANDSCAPE TIPS

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OAK WILT MANAGEMENT BY TIER TREE PART 3: GLYPHOSATE/STUMP CUP

INTRODUCTION

Oak Wilt, caused by *Bretziella fagacearum* (fungus), is a lethal oak (Quercus sp.) disease that can be extremely difficult and expensive to manage (Photo 1). The Tier Tree Model was originally designed by the author in the mid 1980's as a method of containing and eradicating Oak Wilt from sites through use of Root Graft Disruption (RGD); like Dutch Elm

Photo 1: An aerial view of an Oak Wilt outbreak on a golf course near Traverse City, Michigan. The Oak Wilt disease occurred by overland spread to trees pruned near the power lines by a power company's subcontractor.

Disease, Oak Wilt can spread to nearby trees, underground, through root connections we call "root grafts." Root grafts tend to form between trees that are genetically alike or of the same species. RDG techniques were covered in "Oak Wilt Management by Tier Tree: Part 1 Root Graft Disruption", *the Landsculptor,* November 2019, pages 9-13. In the late 1990's and early 2000's, the Tier Tree Model was adapted for use with Tree Injections: please see "Oak Willt Management by Tier Tree: Part 2 Tree Injections, *the Landsculptor*, March 2020, pages 15-19.

During the 1950's through 1970's, RDG for Dutch Elm Disease and Oak Wilt control was often performed with fumigants. Fumigants are broad spectrum biocides that not only kill roots (and hence, root grafts) of trees but will kill virtually every living entity in the soil or environment into which the fumigants are applied. Examples of fumigants include chloropicrin (=tear gas), methyl bromide, and hydrogen cyanide. Although fairly inexpensive, they were very dangerous for the applicator and for anyone coming in contact with the evaporates. Due to environmental hazards, these fumigants have largely been taken off the market, except for some special use situations. The loss of fumigants left a void for Oak Wilt management; subsequently, RGD was largely performed by physical means: trenching and vibratory plowing.

For a little more than a decade, the author has been experimenting with herbicide treatments for Oak Wilt management as an alternative chemical approach for the invasive physical RGD. This article will summarize the results of that research.

POTENTIAL HERBICIDES FOR RDG

There are a variety of herbicidal chemistries that can be utilized to kill trees or, specifically, their roots and hence root grafts. Several of the more common ones used in Forestry/ Arboriculture are Triclopyr, Imazapyr and Glyphosate. The author has not been favorably impressed with the carboxylic acid herbicides (Imazapyr, Triclopyr, etc.) due to their modes of action, extended times to effect death, and due to the numerous observations over the years that trees often recover after treatment (Photos 2A & 2B). In general, the mode of action of carboxylic acid herbicides is to inhibit cell division in the meristematic tissues. With a sufficient dose of the herbicide, the target plant cannot "reproduce" cells and gradually dies. Personal communication with triclopyr users for Oak Wilt management in Texas reveals their belief that triclopyr, if applied in enough concentration, will take 1.5-2 years to kill the roots of trees. If the roots are still alive during that time period, theoretically, the Oak Wilt fungus may be transmitted through the roots and root grafts. If we remember the herbicide Imprelis, another carboxylic acid herbicide released by DuPont 2010-2011 for lawn broadleaf weed control before it was thoroughly tested, many trees were killed . . . but many were drastically affected and then recovered. In the author's experience, glyphosate, with its much different mode of action, is far more effective at killing the roots of trees.

THE THEORY OF OAK WILT RGD WITH HERBICIDES

The use of physical apparatuses for RGD by trenching or vibratory plowing can not only be costly and highly disruptive to the landscape, but they can also cause unwanted damage

Photo 2A: These volunteer silver maple trees (background) on conservation land were sprayed with Triclopyr by a professional applicator. The trees appeared dead for about 1-2 years and then magically re-leafed. In the industry, we might call this job security for the professional herbicide applicator.

Photo 2B: A fool proof technique to kill the trees on this conservation land was to cut and lay them over in windrows. Stumps were subsequently sprayed with concentrated (32%) Glyphosate. The stumps never re-sprouted.

to nontarget trees either in a landscape, woodland or forest, or result in serious complications with utilities. If an herbicide can be applied in enough of a concentrated dose to kill the root system of the target tree, then, theoretically the Oak Wilt fungus will also die with the dying roots. Furthermore, it is hypothesized that dead roots cannot transfer the Oak Wilt fungus. In theory, a tier or two of healthy trees surrounding an Oak Wilt-infecttion site (epicenter) is/are "sacrificed" to prevent the spread of Oak Wilt. With Glyphosate translocating through the initially healthy tree's roots and killing them towards the Oak Wilt-infected trees, the Oak Wilt fungus cannot spread through or outside the sacrificed trees.

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OAK WILT MANAGEMENT BY TIER TREE
PART 3: GLYPHOSATE/STUMP CUP

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THE TECHNIQUE

A "Stump Cup" (or "Trunk Cup") is made with a chain saw at a downward angle 1-2 inches deep beyond the bark into the sapwood (including the xylem and phloem) of the tree to be killed/sacrificed (Figure 1). A "Stump Cup" is what many foresters refer to in other various renditions as a "Frill Cut" or a "Kerf Cut". A "level" Stump Cup is designed to hold a volume of herbicidal liquid that can then be absorbed by the tree's vascular system. A level Stump Cup can be quite challenging if attempted "free hand" (Photo 3). Although a level can be used, simply wrapping a piece of ribbon around the tree and adjusting it by eye leveling is generally adequate (Photo 4). A concentrated (undiluted) solution of glyphosate (30-40% or so) is applied into the Stump Cup (Photos 5A & 5B).

The Stump Cup and Glyphosate is administered according to the Tier Tree Model (Figure 2). The first Tier (or two) of *healthy* Oaks of the same species away/out from the epicenter of infected trees are treated in this manner. The next step is to wait. It is best to allow at least 2-4 weeks for the glyphosate to be absorbed and transported through the tree's root system.

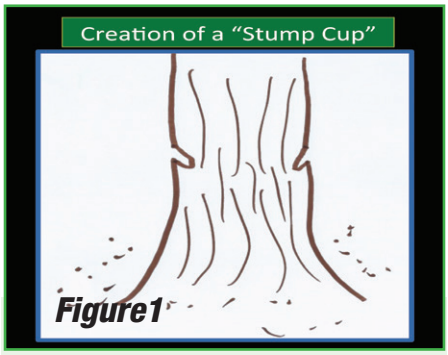

Figure 1: A Stump Cup is made by girdling the target tree with a chain saw approximately 1-2 inches deep beyond the bark. The chain saw is angled to provide a cup to hold sufficient concentrated Glyphosate to kill the roots of the tree.

Photo 3: A level Stump Cup to hold about a cup of concentrated Glyphosate can be quite challenging to make. The author attempted this Stump Cup with less than desirable results.

Photo 4: A ribbon wrapped around the tree and leveled by eye usually provides a guide for making a good Stump Cup. Here, Matt Bainbridge, owner of American Arbor, demonstrates with fine technique and PPE, the making of a good Stump Cup. Note the downward angle of the chain saw to make the "cup."

Photo 5A: Due to potential difficulty of applying a cup of concentrated Glyphosate with an open container (the liquid tends to spill on the bark once tilted beyond 45 degrees), an inexpensive sprayer ($4-5.00) can be used to apply the herbicide to the Stump Cup.

Photo 5B: Note the Glyphosate pooling in this Stump Cup. If the entire amount cannot be applied at one time, simply wait a few minutes for the tree's vascular system to absorb some of the herbicide. If the Glyphosate leaks out of a lower spot in the Stump Cup, stop the leakage with a soil "plug" (arrow).

Why Glyphosate? In the author's opinion, Glyphosate is more effective at killing the roots of trees than other herbicides. And it appears to kill roots of trees *faster* than other herbicides. As we know, there is a great deal of controversy surrounding Glyphosate. In the author's opinion, if Glyphosate is used according to label directions and the protocol outlined in this article, it should be relatively safe for the applicator and environment. The controversy attributed to Glyphosate at the time of this writing is primarily associated with the applicators' use of sprays, and not necessarily to the millions of acres of food crops to which the chemical is being applied. Glyphosate has been deemed relatively safe by the vast majority of health organizations. If anyone is sincerely bothered by the use of Glyphosate, they should probably not use it. Because Glyphosate is the most widely used herbicide/pesticide in the world, it is a natural target for controversy. Please review the article, "The Roundup/Glyphosate Controversy", *the Landsculptor*, June 2019, Pages 13-17. Other commonly used herbicides such as Triclopyr and Imazapyr are much more persistent as active herbicides and may move from the area of application, sometimes leaching through soil and killing other plants.

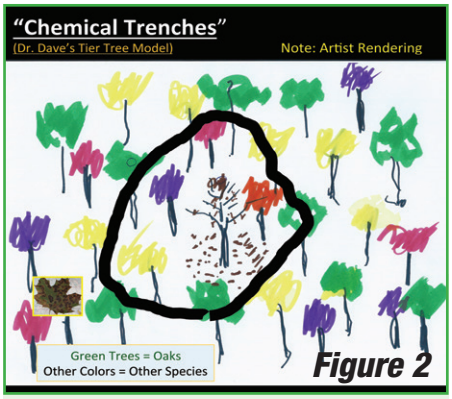

Figure 2: In this schematic of a mixed-species woodland, the tree affected with Oak Wilt has been killed and is obvious. Now comes the task of stopping the Oak Wilt from transmitting underground via root grafts, which tend to occur with the same species of trees. The green trees are oaks. The other colors represent other species: for example, the red trees may be Cherry, the yellow trees may be Yellow Poplar (aka Tulip Poplar), etc. Note the Norway Maple tree affected by Tar Spot (lower left). The first tier of oak trees outlined by a black circle represents the trees to be sacrificed to contain and eradicate Oak Wilt.

Why Stump Cup? The Stump Cup allows for application of enough fungicide to kill the root systems of trees. The prime objective is to apply sufficient chemical to kill the root systems

Photo 6: Many foresters use Triclopyr to inhibit sprouting of stumps after forest trees are harvested for lumber. At this Oak Wilt site near Suttons Bay, Michigan, a government representative recommended the application of Triclopyr to an Oak that was cut down rather than employ the Glyphosate/Stump Cup technique to inhibit underground spread of the Oak Wilt fungus. Note that the stump is sprouting several weeks after herbicide application, indicating the Triclopyr did not kill the roots of the tree.

of trees. Killing the entire root systems of trees should prevent the transmission of the Oak Wilt fungus through root grafts, thereby stopping the spread of Oak Wilt. The one-cup application for smaller trees (10-16" or less dbh) and two-cup application for larger trees seems to do the trick. Foresters have often applied Triclopyr to stump surfaces of removed trees to prevent sprouting (Photo 6); this technique is probably not effective at stopping Oak Wilt transmission through root grafts.

A WORD OF CAUTION!

Glyphosate is a systemic herbicide, and it will translocate through the root system and through root grafts to nearby trees in the tree's vascular system just as the Oak Wilt fungus does. Because of its systemic nature, Glyphosate can harm or even kill trees that may not be targeted. If anyone is uncertain about what this technique with Glyphosate does, please contact the author for advice and assistance. It is advisable to obtain assistance until the applicator becomes confident of the expected outcomes.

EXPECTED RESULTS

If the treatment is applied within the growing season, oak trees will generally collapse within a few days to a week or two. By "collapse," it is meant that leaves will turn lethargic, begin dropping and/or turn tan or different shades of color. The impact of the herbicide on treated trees may resemble symptoms of Oak Wilt on oak trees.

SPECIFIC EXAMPLES OF THE GLYPHOSATE/ STUMP CUP TECHNIQUE

Hartland, Michigan: An "arborist" stopped by Judy's residence one day to ask if he could prune her trees. Luckily (?), she didn't think her landscape trees needed pruning, but, perhaps feeling sympathy for the tree trimmer, suggested he could prune some of her woodland trees . . . and, then, she would pay him. Each of the woodland trees he pruned contracted Oak Wilt (Photo 7A). Judy was beside herself. She had a dense, lovely woodland of mixed species of trees. She understood that physical RGD could be extremely harmful to other species, possibly even killing some of her desirable trees like maple, cherry, hickory, etc. And, she didn't think she could afford to inject all her oak trees with a fungicide for 6-8 years. What was she to do? She was desperate. As a last resort, I suggested she try my Glyphosate/Stump Cup technique, warning her that the method had its advantages and some potentially dangerous disadvantages. Feeling exasperated with her predicament after trying to do a good deed for the tree trimmer, she elected to try the Glyphosate/Stump Cup technique. Her neighbor Bob had a chain saw; Judy had a measuring cup. She would go to her local farm store and buy the concentrated Glyphosate. Results? The technique worked beautifully (Photos 7B and 7C). Bob and Judy were both in their 70's, and with minimal effort and investment, the Oak Wilt was easily contained and eradicated from Judy's property, without harming any of the other species of her woodland trees. I have monitored the property for the last 5-6 years and there has been no resurgence of Oak Wilt after this treatment.

Photo 7A: The brown tree at the center of the photo contracted Oak Wilt by overland spread when the tree was pruned by a tree trimmer at Judy's residence near Hartland, Michigan. With the mixed species of her woodland adjacent to her landscape, Judy was hesitant to trench through the woodland for fear of injuring other species. She was also reluctant to afford tree injections to protect her other oaks.

Photo 7B: Judy elected to try my Glyphosate/Stump Cup technique. Bob, Judy's neighbor, had a chain saw and made some rather enviable Stump Cups "free hand" (inset). This photo was taken a year after treatment; the infected oak had been removed during the winter. Note the ring of the first tier of dead oak trees that had been treated with Glyphosate.

Photo 7C: We sometimes learn from our mistakes. This oak tree was actually in the first tier that should have been Stump-Cupped and treated with Glyphosate; unfortunately, or fortunately, Judy and Bob forgot to treat this tree. The tree showed symptoms of Glyphosate damage the following year from root graft transmission from its neighboring oaks that were sacrificed. The tree has leafed-out every year for the past 5-6 years, getting a little better in health each year, and also indicates that the glyphosate protected it from root graft transmission of the Oak Wilt fungus from the original diseased tree.

Photo 8: At this golf course in Oakland County, several Oak Wilt epicenters in different wooded areas developed from pruning during the high-risk period and from storm damage. In this photo, the three oaks died from overland spread of Oak Wilt to recent pruning injuries. A trench line was placed to the left of the left most infected tree; the trench failed due to inadequate extension into the fairway: the fungus did an end-run around the trench line.

Oakland County: At a golf course in Oakland County, several Oak Wilt outbreaks occurred due to improper pruning during the high-risk period (spring through early summer) and from storm injury. At one location, tree injections and RDG were attempted . . . and failed, due to insufficient trenching depth and length (Photo 8). At another location, the Glyphosate/Stump cup was utilized

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and worked great (Photos 9A & 9B).

Jackson, Michigan: At a location near Jackson, MI, a professional arborist with an enviable log home and extensive woodland property was disadvantaged with a severe Oak Wilt outbreak after storms injured several of his trees. He initially trenched around a large area to contain the rapidly expanding Oak Wilt from several epicenters and performed some tree injections to try to save trees within the trenched area. Becoming frustrated with less than desirable results, he contacted me for some brainstorming and further discussion about remediation efforts. I suggested he try the Glyphosate/Stump Cup technique; he treated several trees within the trenched area as an experiment to observe what would happen. Within a few months, catastrophe struck! The Glyphosate had traveled more than 80-100 feet ***under his trench line*** and killed/injured several trees on the other side of the trench line (Photo 10). The arborist and I were initially very distraught with the results, but we both realized that his RGD trench line was not deep enough (4.5 feet) to prevent Oak Wilt transmission and that eventually the Oak Wilt fungus would've moved beyond his enclosed trenched area anyway. The good part about the unexpected results from the Glyphosate/Stump Cup treatment at this location was that the "fast and furious" movement of the Glyphosate was a valuable lesson in the name of research. As a "nonliving" chemical, whatever impact the Glyphosate caused on the trees outside of the trenched area was done; it would not continue to spread as the biological/living Oak Wilt fungus would have into new sections of his woodland property. Despite the unexpected collateral damage, the glyphosate prevented the Oak Wilt fungus from transmitting through root grafts under his trench line.

Photo 9A: At another location at the same Oakland County golf course as in Photo 8, the tree in the center of the photo developed Oak Wilt from overland spread to a storm-injured branch. It was decided by the managers to try the Glyphosate/Stump Cup technique.

Photo 9B: This photo of the Oak Wilt epicenter in Photo 9A was taken the year following implementation of the Glyphosate Stump Cup method. The infected tree had been removed during the winter, but the two sacrificial trees are readily visible. Again, Oak Wilt remediation was a complete success at this site on this golf course.

Photos 10: At a property near Jackson, Michigan, a professional arborist decided to try to remediate a large Oak Wilt infection site with the Glyphosate/Stump Cup technique. The trees in the distance were treated and were dead at the time the photo was taken; the Glyphosate transmitted through the roots systems and root grafts approximately 80-100 feet *under a 4.5 feet deep trench* and killed the tree in the foreground. Initially distraught, the arborist and I realized his trench was not deep enough; the Glyphosate traveled exactly where the Oak Wilt fungus would have transmitted. Despite the collateral damage, the Glyphosate actually saved many of his trees on the other side of the trench line.

THE COMPREHENSIVE TIER TREE MODEL

With the invention and utilization of the author's Tier Tree Model in the mid-1980's, "The Model" has morphed into three major Oak Wilt remediation techniques: 1) Physical Root Graft Disruption (RDG), 2) Tree Injections with Propiconazole, and 3) The Glyphosate/Stump Cup technique for chemical RGD. These three Tier Tree Model methods can be used separately or in conjunction with one another. In some Oak Wilt situations, the author has recommended all three methods. For example, at a site near Grand Rapids, a Tier Tree Model RGD trench was installed and trees outside the trench line were injected with propiconazole for added insurance (Photo 11). After the trench line was in place and healthy trees were protected with tree injections, it was recommended that the Glyphosate/Stump Cup technique be applied to the lone infected tree; this would ensure that any root grafts that escaped disruption by trenching would be destroyed by the Glyphosate. There are many other permutations of these three Tier Tree Model techniques.

SUMMARY

The Glyphosate/Stump Cup technique has proven to be a highly effective and useful tool for Oak Wilt containment and eradication. If employed correctly it can be less destructive

Photo 11: At this residential site near Grand Rapids, Michigan, a single Oak tree (arrow) was infected when the property owner pruned a single branch for better clearance when mowing his yard. The Tier Tree Model specified the RGD line (yellow), and trees outside the trench line were injected with propiconazole for added insurance of protection from Underground Oak Wilt transmission. In some situations, the author would also recommend the Glyphosate/Stump Cup treatment *on the diseased tree* (arrow) ***after trenching*** to ensure that no root grafts escaped the physical RGD.

Photo 12: This 2.5-gallon jug of Glyphosate prescribed for treating trees on the label and costs around $30.00. Calculating the number of doses for the Glyphosate Stump Cup technique, the treatment per tree amounts to about $1.00! We cannot obtain a much less expensive treatment for Oak Wilt than that!! Standard Oak Wilt remediation efforts often cost $1000s-$10,000s. (The author does not endorse any particular brand of Glyphosate).

than the Bruhn Model for RGD. It can also be more effective - I have never witnessed the Oak Wilt fungus escaping a One-Tier Tree treatment with the Glyphosate/Stump Cup method, while there are reports of physical RGD failures. Glyphosate is systemic and remains within the treated trees(s), only affecting the species of tree that have been treated and not other tree species in mixed woodland/forest stands. At the dose recommended in this article, treated trees are killed and there has never been any recovery of those treated trees. I have also never witnessed a failure of the technique to contain, stop and eradicate Oak Wilt if used according to the instructions in this article. Of considerable benefit, compared to most other Oak Wilt treatment protocols, this is the most cost-effective treatment for the management of Oak Wilt. The cost of a 2.5 gallon jug of Glyphosate (Photo 12, around $30) indicates that the investment to control Oak Wilt amounts to about $1.00 per tree . . . plus some chain saw work. The time investment of creating the Stump Cup and application of the Glyphosate is also minimal, perhaps estimated at 10 minutes per tree. A person with a chain saw and a container of Glyphosate can contain and eradicate an Oak Wilt infection center with minimal time and investment.

There are some potential downsides to this technique, perhaps, most likely due to misunderstandings about the herbicide and the technique. For example, some individuals, even arborists, do not realize that glyphosate is systemic within trees. Hence, some have proposed treating and sacrificing trees directly adjacent to trees deemed to be preserved. And even though the technique has been 100% effective, there is a range of detrimental impacts on non-target Oak trees ranging from no impact to death. If anyone is uncertain about how and where to use the Glyphosate/Stump Cup technique, be sure to contact the author for more information and assistance.

The Glyphosate/Stump Cup technique exhibits great potential for highly effective and economical containment/eradication of Oak Wilt. In the author's opinion, it could easily replace the Bruhn RGD Model for forests with much less effort and far less expense than standard vibratory plowing . . . if dedicated users of the Bruhn Model were to think "outside the box." The technique is especially effective and safe in mixed stand of trees, causing no collateral damage on other species of trees compared to trenching models. This technique could also be highly beneficial in sensitive environments such as critical dune areas where soil profile disruption is not advisable. And, it can be used in residential woodlands and landscapes if Glyphosate's use is carefully thought out to avoid unwanted consequences. Because Glyphosate seems to move faster and farther through roots systems than the Oak Wilt fungus, experimentation with Glyphosate as a "Chaser" treatment on infected oaks has been initiated. The author will keep interested readers apprised as new information is generated. L

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